Using Ocean Data Assimilation for Observing System Studies with a Focus on the Tropical Pacific

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Data assimilation systems provide a mechanism for evaluating the impact of observing systems for specialized applications, such as weather or climate forecasts. Typically, this is done through data denial experiments. Here we use the Goddard Earth Observing System integrated Ocean Data Assimilation System (GEOS iODAS) to study the impact of ocean observing systems in the tropical Pacific. In particular, the experiments consider the relative impact of TAO and Argo on estimates of temperature and salinity across the equatorial Pacific. Three experiments are conducted from 1993-2012, all assimilating sea-surface temperature (SST) and sea-level anomaly (SLA) data, but with perturbations in the use of TAO and Argo:
1. EXP_Argo (assimilating Argo or synthetic Argo data, but not TAO).
2. EXP_TAO (assimilating TAO data, but not Argo)
3. EXP_ALL (assimilating TAO, Argo, and other in-situ data)

Whereas the three analyses are very close in terms of heat and salt content in the upper 300 m, significant differences are evident in the thermocline region. Differences are largest in the eastern Pacific where the mean difference reaches ~ 1°C and RMS differences are up to ~ 1.5 °C at about 100 m at 125°W. In comparison with TAO temperature data at that location and depth, the analysis from experiment EXP_Argo (EXP-TAO) has an RMS difference of 2.9°C (2.0°C) and correlation of 0.75 (0.78). We will present a comparison and evaluation of the different experiments as well as their impacts on seasonal-to-interannual forecasts using the GMAO GEOS-5 Forecasting System.